Field Investigations of Lactate-Stimulated Bioreduction of Cr(VI) to Cr(III) at Hanford 100H

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Cr(VI), which is widely distributed at one of the most contaminated DOE sites, Hanford, is migrating to the Columbia River. One of the most promising new remediation technologies for chromium-contaminated groundwater is in situ bioreduction. This field project is a direct extension of laboratory studies that demonstrated the biogeochemical transport effects of carbon on stimulation of bioreduction of chromium in soil cores (Tokunaga et al., 2001a,b). The overall objective of this project is to carry out field investigations to demonstrate a feasibility of a cost-effective, in-situ remediation technology, using lactate-stimulated bioreduction of dissolved Cr(VI) to form an insoluble mineral precipitation of Cr(III) at the Hanford 100H area. Specific goals are: (1) Design of a field test to develop design criteria for full-scale deployment of in situ Cr(VI) bioreduction via lactate stimulation for the use at DOE sites, (2) Provide field testing and monitoring (including geophysical methods) of the effects of lactate biostimulation on microbial community activity, redox gradients, transport limitations, and other reducing agents, and compare the field results with those of our previous laboratory work, (3) Assess the kinetic rates and conditions that may cause reoxidation of Cr(III) to Cr(VI) after biostimulation is terminated, (4) Assess the use of bioremediation in conjunction with other alternative remediation technologies, such as a pump-and-treat approach for the Hanford 100H site. Sediment samples from the field site have shown that the microbial densities are quite low ($<10^4$ cells/g), but are easily stimulated with lactate to densities $>10^8$ cells/g in just a week. The sediments in the target zone were also shown to be dominated by bacteria known to reduce Cr (*Geobacter* and *Desulfovibrio*). The results of the planned field injection will be presented. The studies of this project will be used to develop a conceptual model of chromium bioreduction in groundwater at a field scale, showing how much of the Cr(VI) reduction is microbial (indirectly or directly), and how much of it is abiotic, and to provide recommendations for field deployment of lactate-stimulated bioremediation.